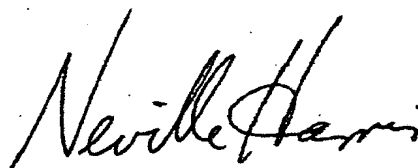


CERTIFICATE

This certificate is issued in support of an application for Patent registration in a country outside New Zealand pursuant to the Patents Act 1953 and the Regulations thereunder.

I hereby certify that annexed is a true copy of the Provisional Specification as filed on 11 July 2002 with an application for Letters Patent number 520115 made by UNITEC INSTITUTE OF TECHNOLOGY and MARK IRVINE TUCKER.

Dated 8 July 2003.



Neville Harris
Commissioner of Patents

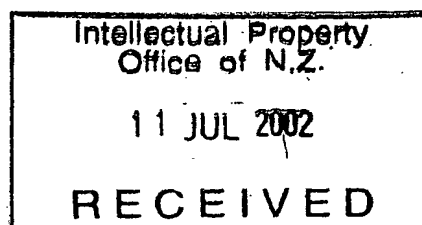


NEW ZEALAND
PATENTS ACT, 1953

PROVISIONAL SPECIFICATION

"A Panel and Related Wall Structure"

We, **UNITEC INSTITUTE OF TECHNOLOGY**, a New Zealand institution under the Education Act 1989 of Carrington Road, Mt Albert, Auckland, New Zealand and **MARK IRVINE TUCKER**, a New Zealand citizen of 17b Impala Place, Hillsborough, New Zealand, do hereby declare this invention to be described in the following statement:



The present invention relates to a panel and related wall structure and in particular to a sound absorbing panel and structure which although not essentially but, preferably is used as a building panel such as a wall or ceiling panel.

Wall and ceiling panels made out of a gypsum based material are well known. Such panels are often also called plaster board and consists of a core of gypsum material overlaid on each side by a paper sheet. Such panels are used to be placed against framing timber to provide a lining for an interior surface of a room of a house or building or the like. Similarly suspended ceilings may be provided wherein the plaster board is suspended from a framing structure to thereby reduce the degree of vibrational transmission of sound between the spaces separated by the plaster board.

Such additional steps in providing a further sound proofing can however be costly and it is advantageous if a single sheet of a building panel can be provided wherein significant or adequate sound absorption effects are provided by that panel alone. It will be appreciated that the provision of a rubber intermediary member adds steps to the installation procedure of lining a room of a building.

The sound transmission loss of a partition is determined by physical factors such as mass and hardness. In double layer assembly, such as gypsum wall board on wood framing, the depth of air spaces, the presence or absence of sound absorbing materials and the degree of mechanical coupling between layers critically affect sound transmission losses and therefore the Coefficient of Sound Transmission Loss. An understanding of these factors can lead to improved design and fewer errors. Small changes in the arrangement of materials can yield changes in STL with little or no increase in cost.

Sound is generated by creating a disturbance of air, which sets up a series of pressure waves propagate in all directions from the source of the sound. As well as travelling in air, sound can travel as vibration waves in solids or liquids.

Two basic aspects govern the acoustical conditions in rooms: first the amount of background noise, and second the acoustical properties of the room itself, as determined by the geometrical arrangement and materials of the room. On the other hand, there are three steps to the acoustical design rooms: first selecting optimum criteria to be achieved dependent on the intended use, second designing to achieve these criteria, and third verification that the design goals are achieved in the finished building. It is common

knowledge that for typical partitions, the transmission loss is much smaller for low frequency sounds than for high frequency sounds.

Accordingly it is an object of the present invention to provide a panel which overcomes the abovementioned disadvantages or which at least provides the public with a useful choice.

Accordingly the present invention consists in a panel comprising
a first layer of a gypsum material providing an exterior surface of the panel and provided on the other surface thereof a second layer of material

said second layer including a gypsum having a plurality of substantially homogenously provided cavities, said cavities having been provided by an anhydrate material which upon the release of water therefrom has shrunk leaving a said plurality of cavities.

Preferably provided on the surface of said second layer away from said first layer there is provided a third layer which cover the other surface of said second layer.

Preferably said third layer is substantially similar to said second layer said third layer.

Preferably said third layer has a normal to the exterior surface thereof projecting in the opposite direction away from said panel to the normal of the exterior surface of said first layer.

Preferably at least one of said first or third layers is provided with a textured surface consisting of a plurality of upstands preferably provided as a pattern to the exterior surface of the at least first or third layer.

Preferably said first and third layer is substantially of gypsum.

Preferably said third and first layer includes EVA.

Preferably said first and third layer includes a fibreglass.

Preferably said cavities include a polyacrylate.

Preferably said cavities include potassium polyacrylate.

In a further aspect the present invention consists in a method of providing a panel which comprises the steps of

a) providing a hydrated mixture of gypsum precursor and anhydrate provided homogenously there through to a layer preferably also of a hydrated gypsum but without

said anhydrate,

- b) allowing dehydration and hence a hardening of the materials to occur.

Preferably the method further includes the provision of a layer of materials to the exposed surface of the layer of hydrated gypsum and anhydrate.

Preferably said third layer is of a gypsum material.

Preferably said anhydrate is a polyacrylate.

Preferably said polyacrylate is potassium acrylate.

Preferably said third layer is applied in a dry powdered form to the upper surface of said second layer.

Preferably said third layer is applied when the second layer is still at least partially hydrated.

Preferably said third layer prior to it setting is screeded to provide the desired surface texture.

Preferably a fibrous material is laid into at least one of the layers.

Preferably said fibrous material is fibreglass.

Preferably said fibreglass is laid into all of the layers.

In a further aspect the present invention consists in a space laminated wall (not limited to its orientation to the horizontal) secured to a structural component(s) of a building said wall comprising

a first sheet and at least one other sheet

said first sheet mounted from said structural component

said second sheet mounted from said first sheet in a substantially parallel manner but separated therefrom to define a space therebetween by at least one kind of spacer.

Preferably said at least one other sheet is mounted outwardly away from said structural component with said first sheet.

Preferably said first sheet is of a kind as herein before described.

Preferably said at least one other sheet is a solid gypsum board.

Preferably said spacer is at least one of a foamed rubber material and adhesive.

Preferably said first sheet is affixed to the structural component via at least one rail.

Preferably said rail is nailed or screwed to a structural component such as a stud and

said first sheet is in turn screwed to said rail at appropriate intervals.

Preferably the surface of said first panel exposed in said space is of a non smooth surface.

Preferably said surface of said first panel exposed in said space is profiled.

Preferably said surface of said first panel exposed in said space is profile to define surface upstands preferably of a repeating pattern.

Preferably said wall is made up of a plurality of juxtaposed first and at least one other sheets in an edge to edge arrangement.

Preferably said spacer is a strip material and extends at least proximate to the perimeter of the wall defined by the juxtaposed sheets.

This invention may also be said broadly to consist in the parts, elements and features referred to or indicated in the specification of the application, individually or collectively, and any or all combinations of any two or more of said parts, elements or features, and where specific integers are mentioned herein which have known equivalents in the art to which this invention relates, such known equivalents are deemed to be incorporated herein as if individually set forth.

Figure 1 is a sectional view through a preferred form of the panel of the present invention,

Figure 2 is a side view of a panel of the present invention, and

Figure 3 is a sectional view through an installation which includes the panel of the present invention to define a sound absorbing wall structure.

It is important to recognise that the overall function of a wall, in conjunction with floors, and roofs, is to provide a barrier between two environments, so that one environment can be adjusted and maintained within acceptable limits.

A wall is a selective separator between two spaces where between an actual or potential flow or energy is involved. The greater the difference between the two spaces the greater is the stress of duty imposed on the wall. Thus, the elements of the wall must be selected so that in the first instance they impart the necessary resistance to keep noise levels within acceptable limits. The way they are arranged, however, is also important. This will determine the variation in conditions throughout the wall. Interaction between various factors involved may produce conditions within the wall that require special

attention.

The panel of the present invention provides a convenient way of absorbing some noise transmission through the panel while still allowing it to be maintained within a standard thickness wall panel which are commonly used in the building trade and in configuration preferably includes two layers of a gypsum based material. A first layer also herein referred to as the face gauge 1 consists of a gypsum based material and provides a substantially solid thin walled section to the panel of the present invention. The face gauge is that layer of the panel which provides its exposed surface 2 to be provided in a condition in use to be exposed into the room but which can later be subjected to further treatment such as priming and painting or for the application of a paper layer or similar cellulosic material.

The face gauge 1 is preferably of a high density material and hence in the method of providing the panel, this face gauge is preferably in a form to provide a high density thin wall to the panel and may be for example be provided by a reasonably low water content wet mix of solidified gypsum pre-cursor. The face gauge 1 is provided in a mould or onto a mould in its wet form and is spread to a thickness of for example 2mm. Provided on top of the face gauge (i.e. against the surface of the face gauge away from the exposed surface 2 of the face gauge is a material which is herein defined as the body gauge 3. The body gauge consists of a gypsum material which has been mixed with a hydrated gelling material such as an anhydrate as potassium polyacrylate. An example of a potassium polyacrylate is that known by the trade mark TERAWETTM which is a crosslinked potassium polyacrylate/polyacrylamide copolymer which comes in the form of white granules and has a bulk density of 540 ± 40 grams per cubic meter. Its Ph value is somewhere between 6-6.8. TerawetTM is a product which upon contact with water results in rapid swelling as a result of electrical forces pushing the inward structure of the particle away from the centre. Small spaces are created inside the particle which attract water. When water is drawn away from the polymer the particle shrinks in volume. With the provision of hydrated potassium polyacrylate with the gypsum to define the body gauge, a substantially solid, in its wet form, layer of material is applied to the inwardly facing surface 10 of the face gauge 1. This body gauge may then be allowed to cure along with curing of the face gauge. However preferably a third layer, a backing gauge 4 is

provided to the then upwardly facing surface of the body gauge 3. The backing gauge is preferably made of a substantially similar material to the face gauge 1. The body gauge may be provided in the form of 8.5mm layer intermediate of the vacuum gauge and face gauge. Further intermediate layers may be provided of a different kind however the most preferred form of the panel is as shown, in cross section in Figure 1.

Upon the curing of the gypsum material moisture is drawn out from the wet phase of the face, backing and body gauges. As the potassium polyacrylate also contains water, upon the curing of the panel, that water is removed from the potassium polyacrylate. The potassium polyacrylate becomes dehydrated and reduces in volume. As it reduces in volume, cavities are formed within the body gauge such cavities being substantially of a size of the wet or hydrated phase of the potassium polyacrylate. The shrinking of the potassium polyacrylate therefore leaves cavities within the panel. The application of the backing gauge to form part of the panel of the present invention, is achieved during the curing of the face and body gauge. As the curing of the face and body gauge takes place, moisture is floated to the surface of the body gauge. This moisture can be removed by the application of gypsum powder to the upper surface of the body gauge as the moisture is transferred therefrom. The application of gypsum powder to the upper surface of the body gauge provides the backing gauge to the panel of the present invention. In order to achieve a smooth surface to the backing gauge the powdered gypsum that is applied to the surface of the body gauge is smoothed by for example a screed. The thickness of the backing gauge can be built up appropriately to cover the upper surface of the body gauge and to thereby define a panel which is of a desired thickness. By way of example, the thickness of the panel may be provided to approximately 12.5mm.

Cavities in the body gauge, provide a disruption of reverberation of sound through the panel. The panel allows for mild reverberation of the face gauge allowing for a reasonably high percentage of noise to pass through to the body gauge. The reverberation of sound in the body gauge can be captured in the cavities in providing a dissipating effect of the noise. Noise that flanks past the body gauge is in part reverberated back to the cavities from the high density backing panel 4. As a result of the cavities within the body gauge of the panel of the present invention, sound that enters therein is internally reflected and eventually some if not most is absorbed.

To provide strength to the panel, fibre rovings may be provided throughout the panel or provided within at least one of the gauges and preferably within the body gauge 3.

The panel of the present invention with the inclusions of a dehydrated and hydrate will also provide some degree of humidity or moisture absorption.

Further additives may be provided to the gypsum material for the purposes of hardening and such materials may include EPA and indeed anti-mould or antifungal agents may be added particularly considering the possibility of moisture absorption being provided by the anhydrates. Table 1 shows one example of material detail.

The panel of the present invention may further be provided with a surface modification to at least one of the outwardly facing surfaces of the face gauge or backing gauge 1,4. Such a surface modification is by way of a pattern of upstands provide and a disruption to the otherwise flat exterior surface of the panel.

With the provision of surface modifications to at least one and alternatively to both of the outwardly facing surfaces of the panel of the present invention, further sound absorption may be catered for. Surface upstands which may be provided as a pattern to the surface of the panel can provide further sound deflection and with reference to Figure 3, wherein the panel is provided within a sound absorbing structure, the surface modifications 12 may be provided exposed into a cavity which is defined between the panel and an other like or other type of panel 13. The panel 13 may be a standard plaster board sheet which is provided in association to the panel of the present invention and wherein the surface modifications 12 are provided within the cavities provided between two panels 14, 13. The surface modifications will provide a disruption to the sound waves endeavouring to travel into the panel 14 from any sound transmitted from the inwardly facing surface of the panel 13. To prevent direct vibrational transmissions between the two panels a spacer 15 of a low hardness material such as a foamed rubber which is provided to create a space lamination.

may be provided at appropriate locations between the panels 13 and 14. This spacer will reduce the incidence of material vibrational transmission of sound.

The panel 14 is preferably mounted to a frame work structure 16 of a building such as timber framing by way of mounts 17. Such mounts may be rails of an extruded or roll

formed kind to which the panel structure of the panels 13, 14 are mounted. Rubber grommets 21 or strip material may be further provided intermediate of the structure 16 and the mounts 17 and/or between the mounts 17 and the panel 14. With reference to Figure 5, there is shown a detailed view of the arrangement wherein the panel is provided to a timber framing as for example shown in Figure 16.

A putty like material may be provided to overlay the positions where the fastening means 22 may be provided to secure the panel 14 to the rails 17. The application of such a putty 23 provides a sound seal to the migration of sound via the fastening means 22 to or from the other side of the panel 14 to which it is provided.

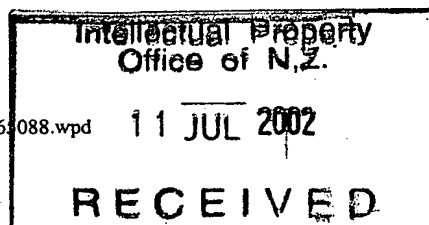
With reference to Figure 6, a wall utilising the panel construction of the present invention may be provided wherein a plurality of panels are provided adjacent to each other. Such a plurality of panels 20 are preferably engaged to adjacent like panels as for example shown in Figure 4. A sound sealing material 25 may be provided intermediate of the panels to thereby reduce transmission of vibration between adjacent panels.

The spacer seal 15 may extend around or approximate to the formed perimeter of the plurality of panels and intermediate of the spacer there may be provided a sound absorbing putty 26. Such a sound absorbing putting for similar material may also be provided external of the seal 15.

The exterior panel 13 may preferably be adhered to the panel 14 by adhesive regions 27. The adhesive is that which holds the facing panel 13 to the inner panel 14.

TABLE 1

Type	Gauge	Weight Per Thickness	Thickness
Swelled anhydrates	Body	1.42 kg/m ²	8.5mm
Hardened (EPA)	(i) Face	19mlt/m ²	2mm
	(ii) Backing	76 mtl/m ²	8.5mm
	(iii) Body		
Fiber-glass strands	Body gauge surface	220 gms/m ²	8.5mm



DATED THIS 14th DAY OF July 2002
AJ PARK
PER *J. Finlay*
AGENTS FOR THE APPLICANT

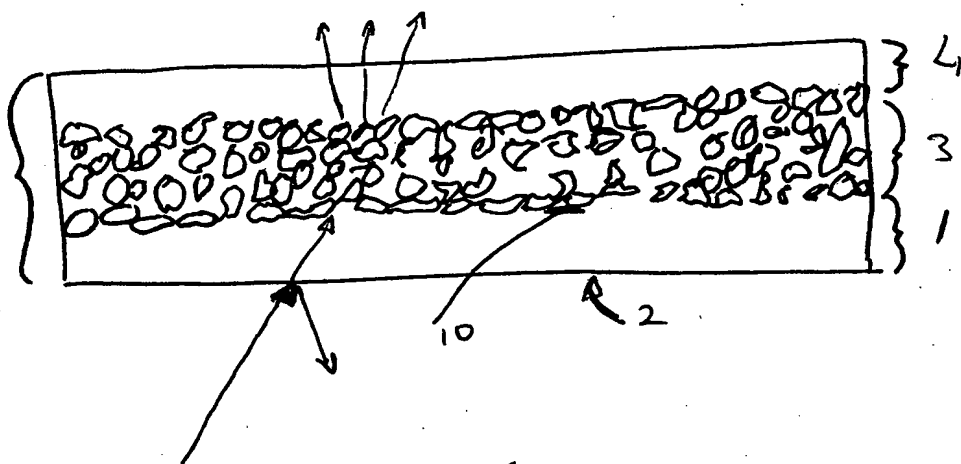


Figure 1

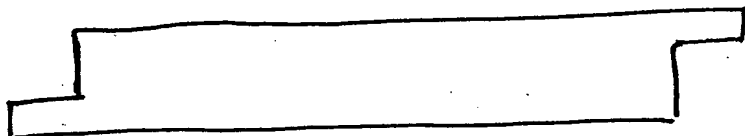


Figure 2

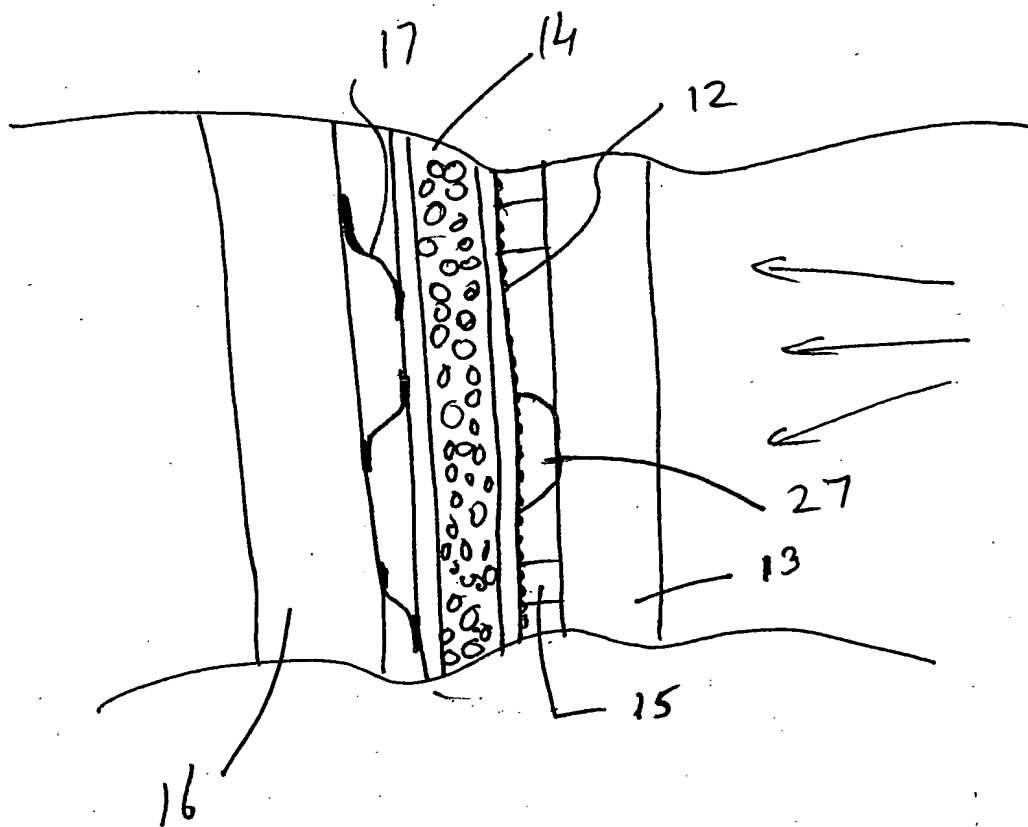


Figure 3

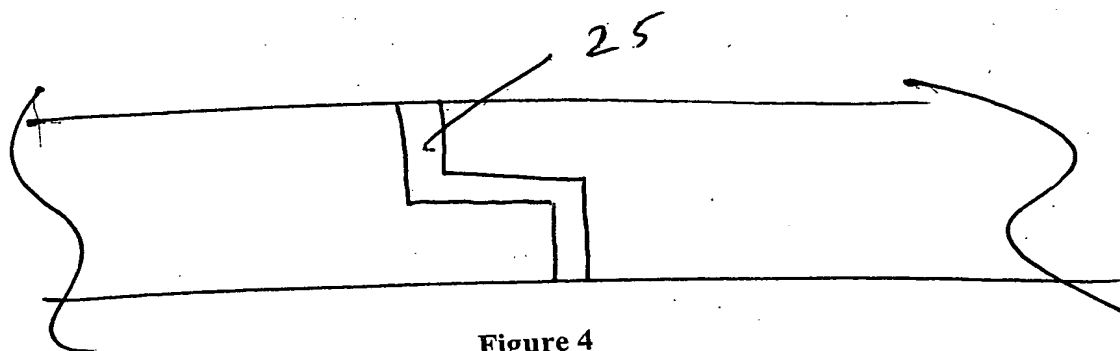


Figure 4

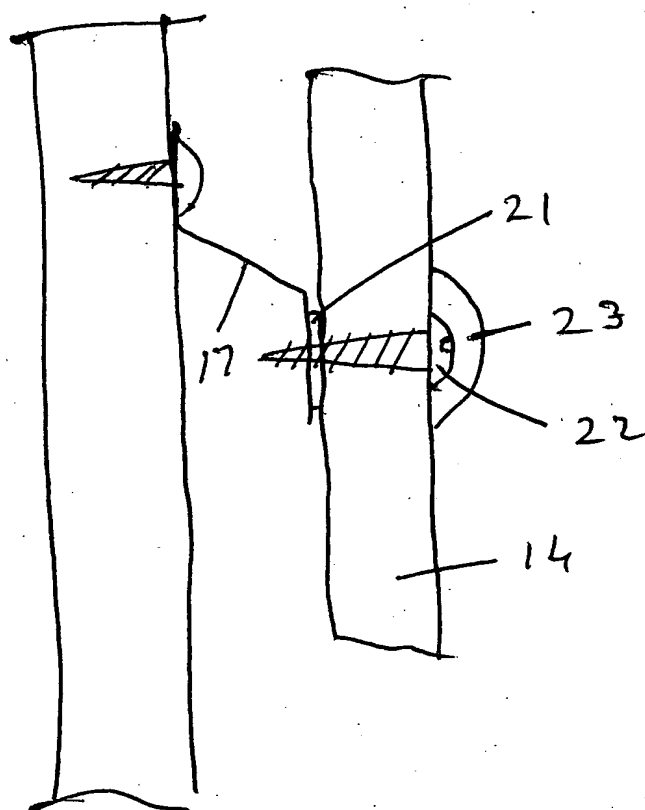


Figure 5

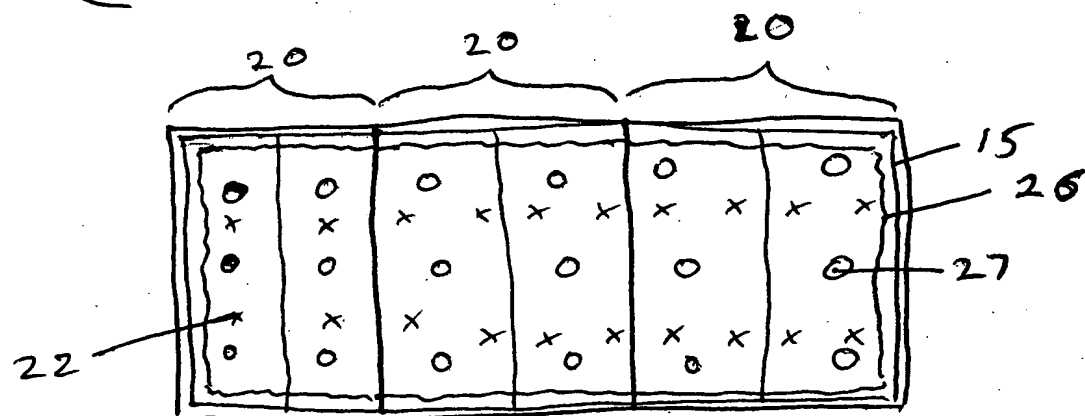


Figure 6